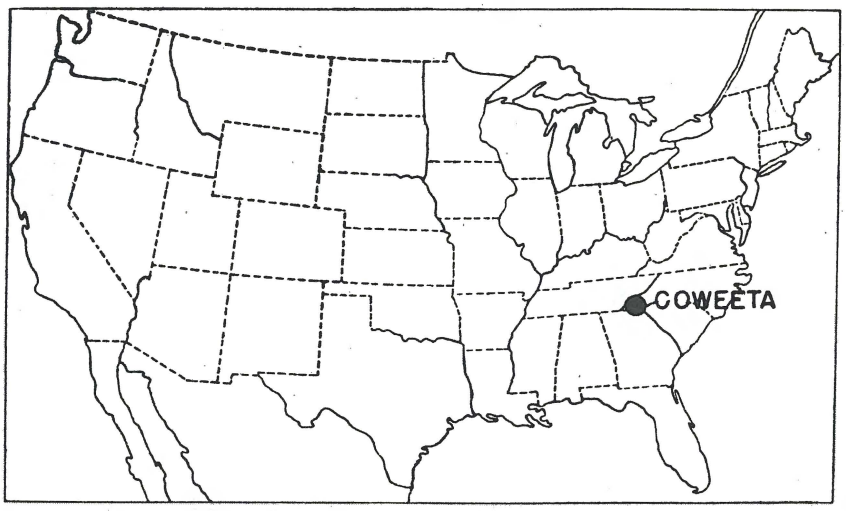
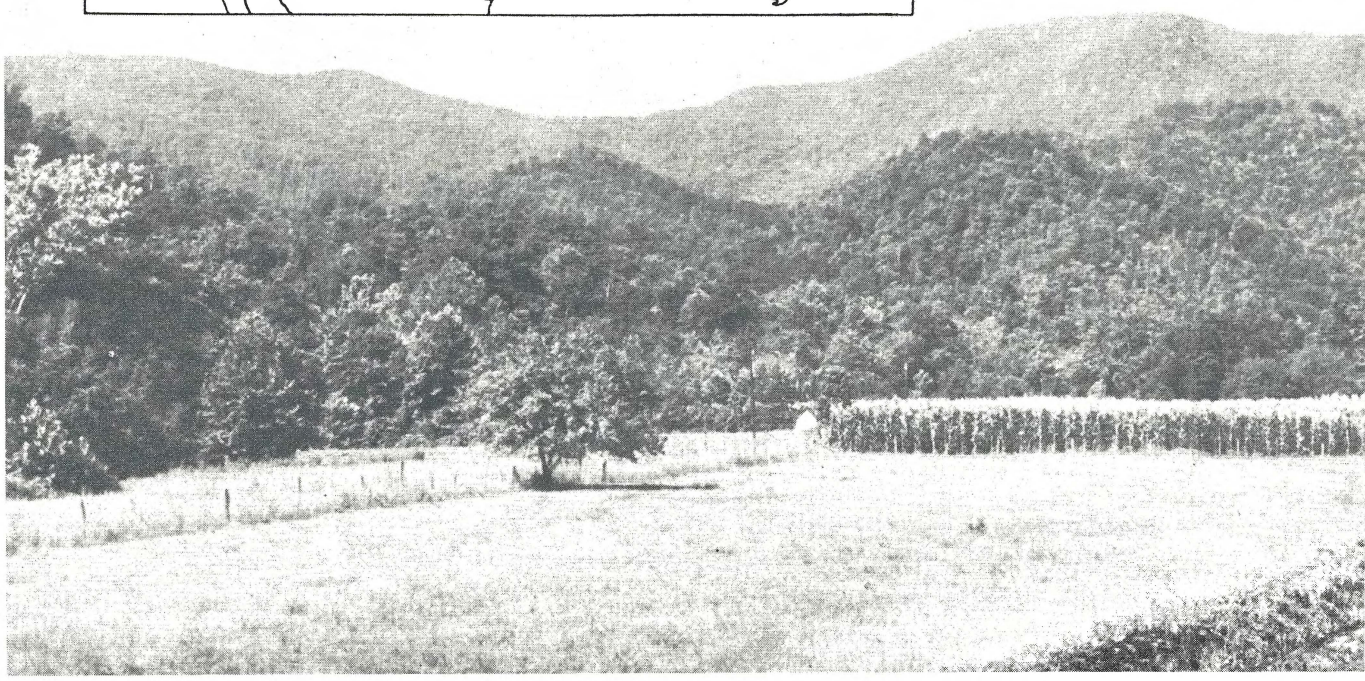
WATERS OF COWEETA

U. S. DEPARTMENT OF AGRICULTURE
Forest Service . . . A.I.B. 117





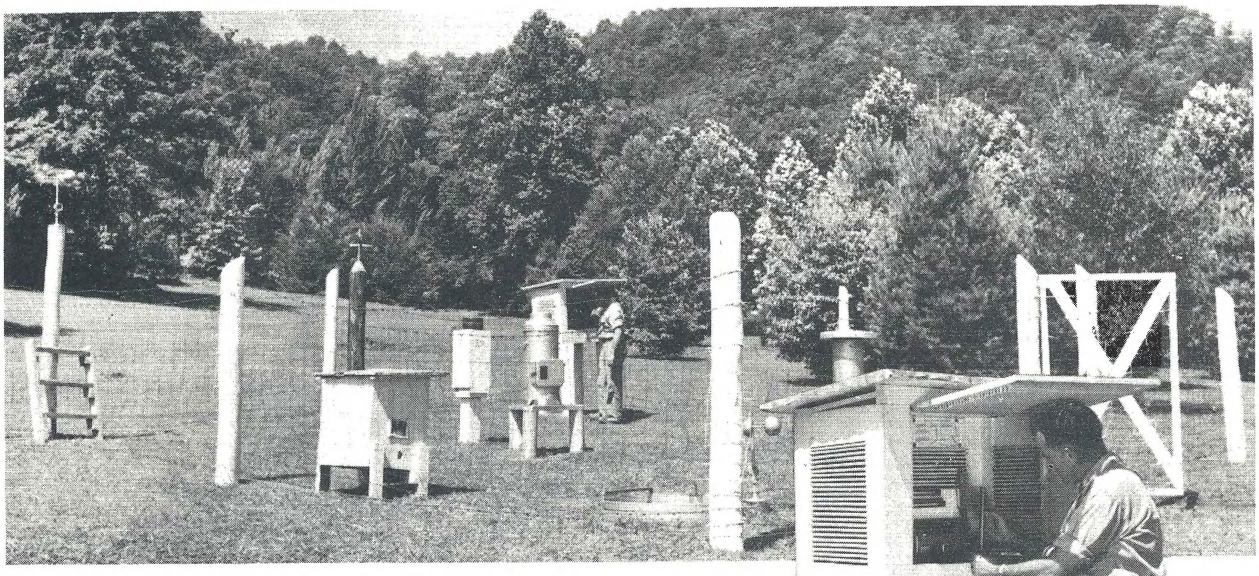
F-469651

In the Appalachian Mountains of North Carolina, near Franklin, there is a great outdoor laboratory where little waters are writing big stories for the future good of all Americans. At this Coweeta Hydrologic Laboratory, one of several experimental forests and ranges where the U. S. Forest Service is carrying on intensive watershed studies, forest scientists are finding practical answers to water problems that have long puzzled engineers and foresters alike.

This publication is designed to highlight the results of 20 years of streamflow studies at Coweeta, borrowing text and pictorial illustrations from the documentary film, "Waters of Coweeta."

The Coweeta watershed or drainage basin is made up of numerous small watersheds with their little mountain streams flowing into larger streams, then into Coweeta Creek, and eventually into the mighty Ohio River itself by way of the Little Tennessee and Tennessee Rivers.

F-469784



F-469666

These are the scientific instruments that play their part in writing a history of Coweeta weather.

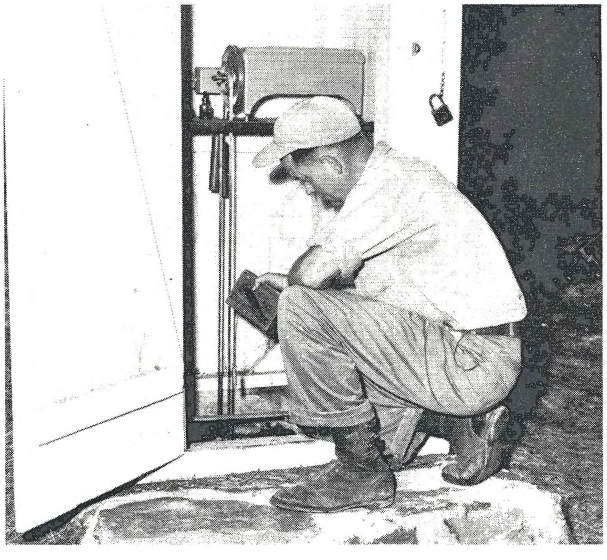
Weather stations record every phase of wind, temperature, and humidity.

F-469669

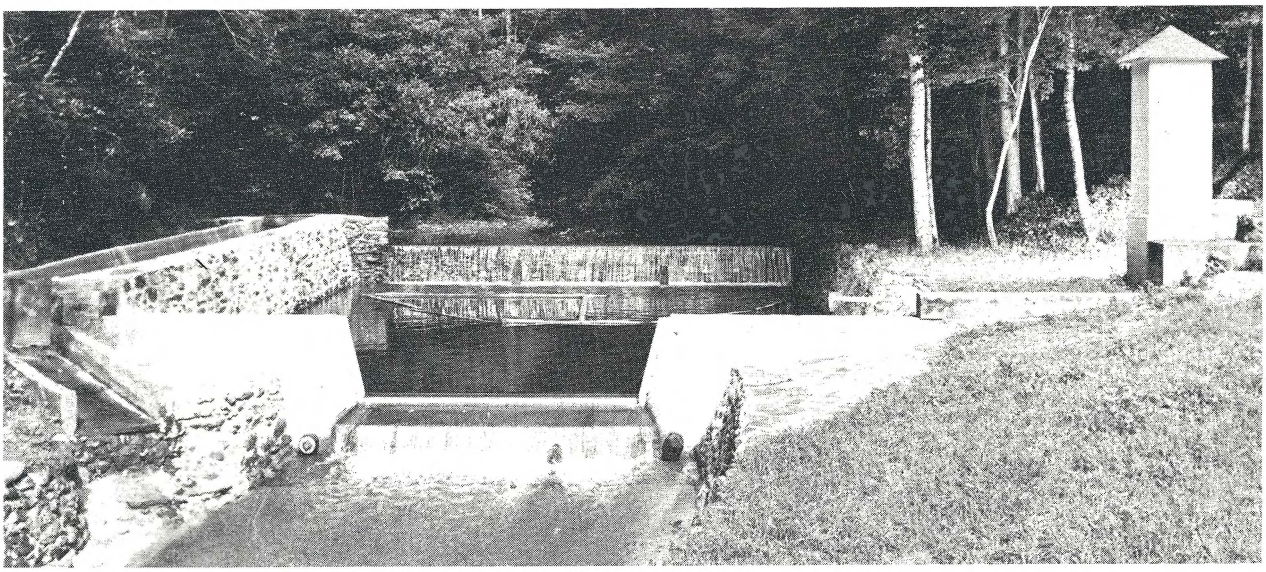
Rain gages tally every storm and the rainfall for an entire season.

F-469679

Observation wells give an automatic, accurate measure of the water table.

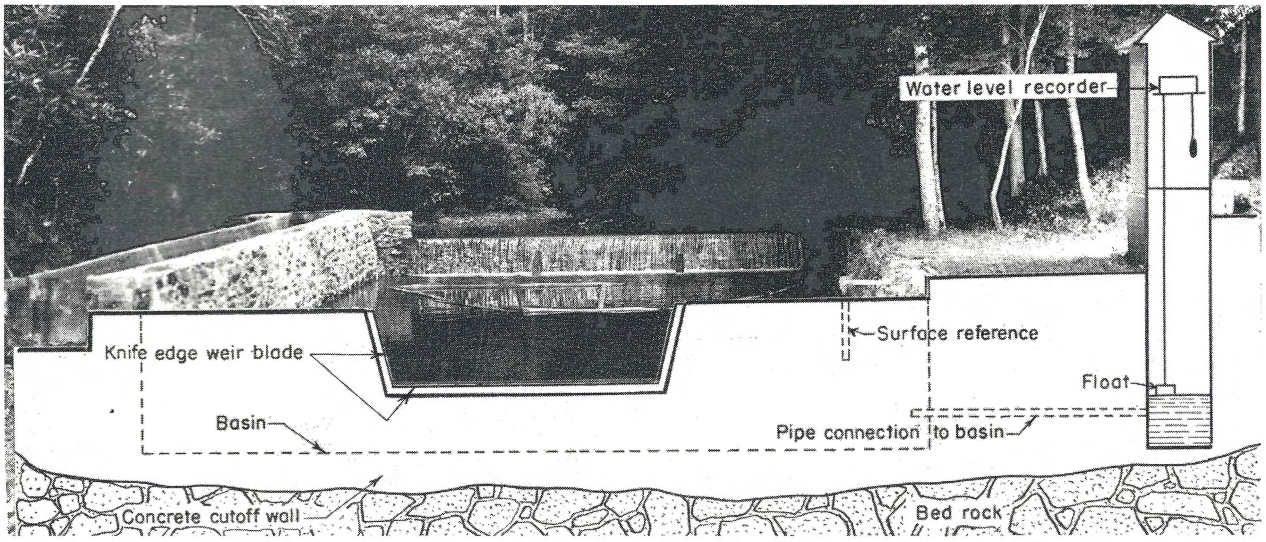


F-469684

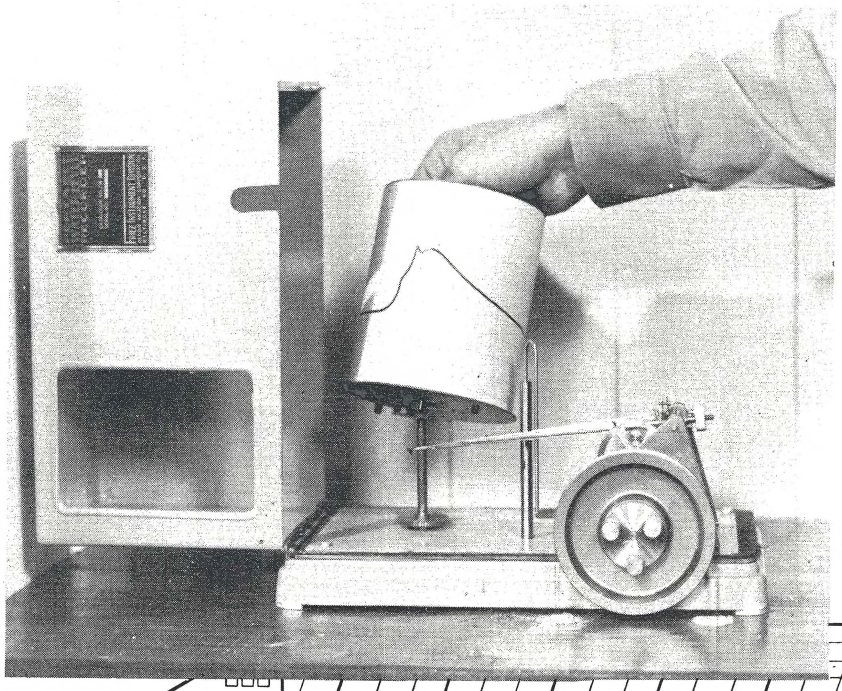


F-469731

On the streams themselves, there are the weirs—concrete dams, precision-built to record the waterflow continuously. Since every drop of water flowing from a watershed becomes an integral part of the stream's record, the weir must be built with painstaking care. The concrete cutoff wall is anchored to bedrock. Therefore, all the water must flow across the weir blade . . . a scientific instrument, constructed to precise hydraulic standards. The volume of flow across the blade is determined by the level of the water in the basin behind the dam. Through connecting pipes, the water in the basin and in a special concrete well are maintained at the same level. Directly above this well is the gage house. Here the automatic water-level recorder is located.



The water-level recorder enables each stream to write its own diary, recording its flow in every weather, dry periods as well as storms. The flow records are inscribed on special charts called hydrographs by the scientists.



F-469664

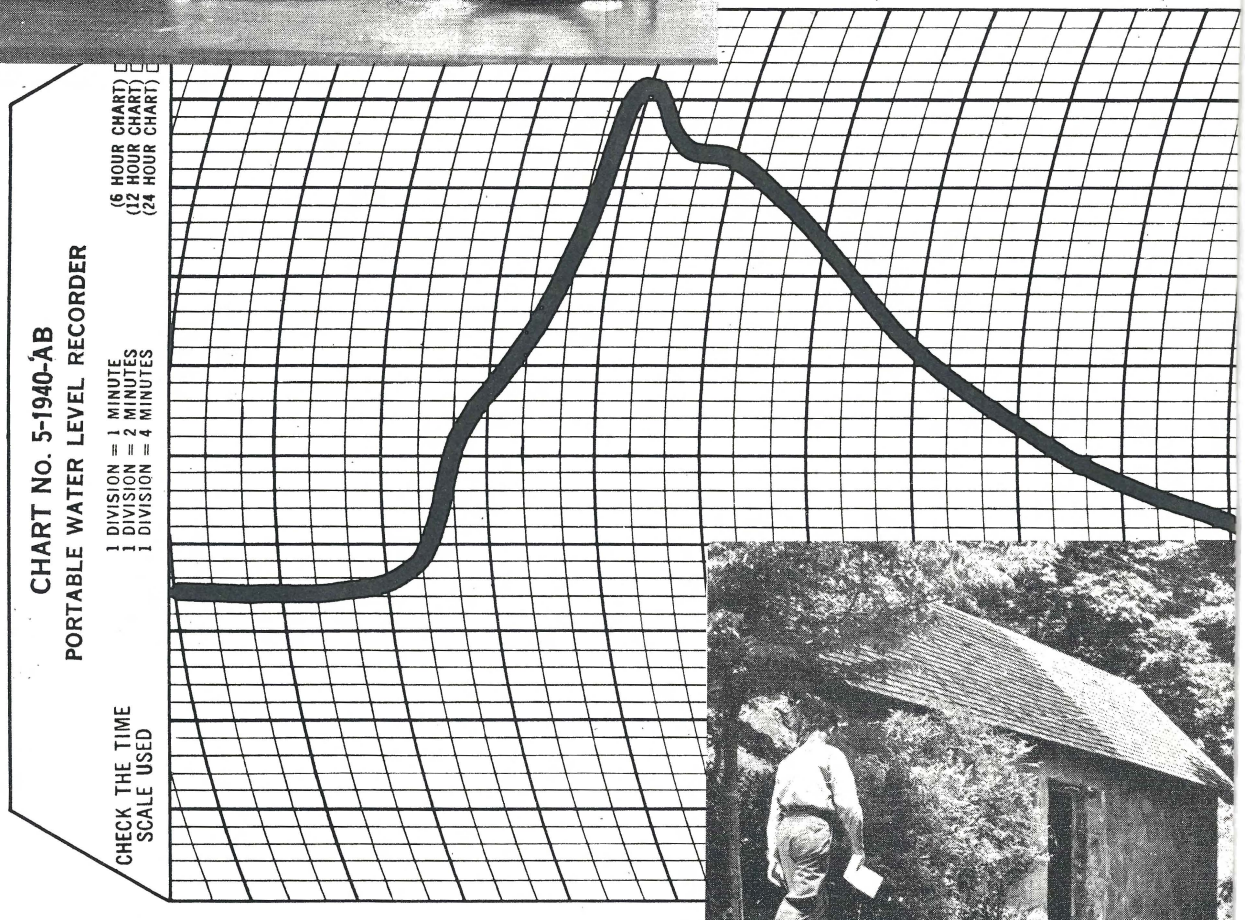
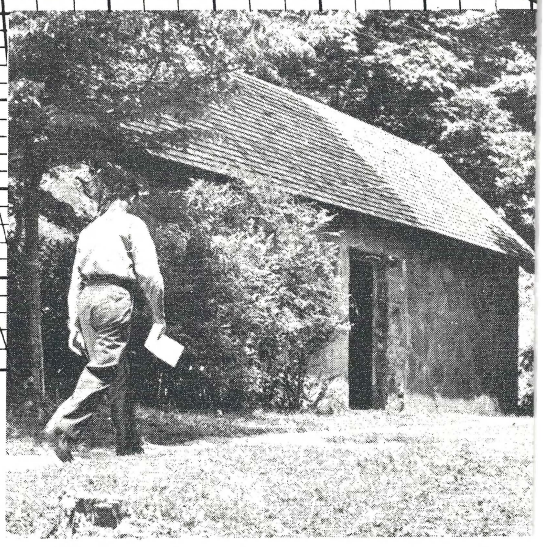
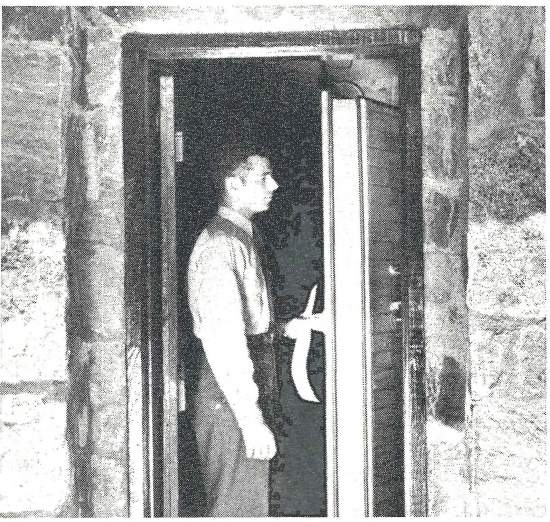


CHART No. 5-1940-AB
PORTABLE WATER LEVEL RECORDER
1 DIVISION = 1 MINUTE
1 DIVISION = 2 MINUTES
1 DIVISION = 4 MINUTES
(6 HOUR CHART)
(12 HOUR CHART)
(24 HOUR CHART)
CHECK THE TIME SCALE USED



F-469690

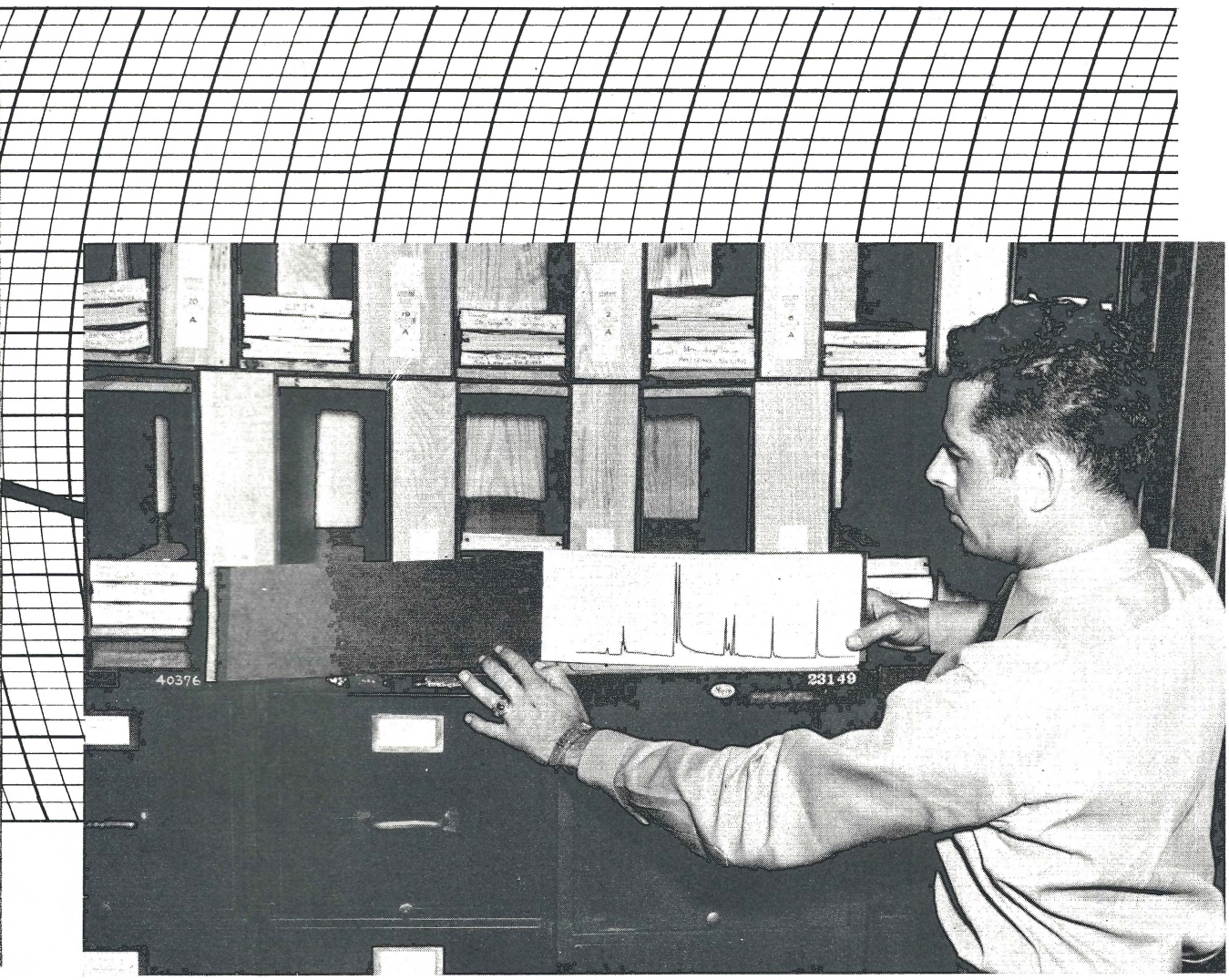
To insure the safety of the priceless stream records, they are kept in a stormproof, fireproof vault.



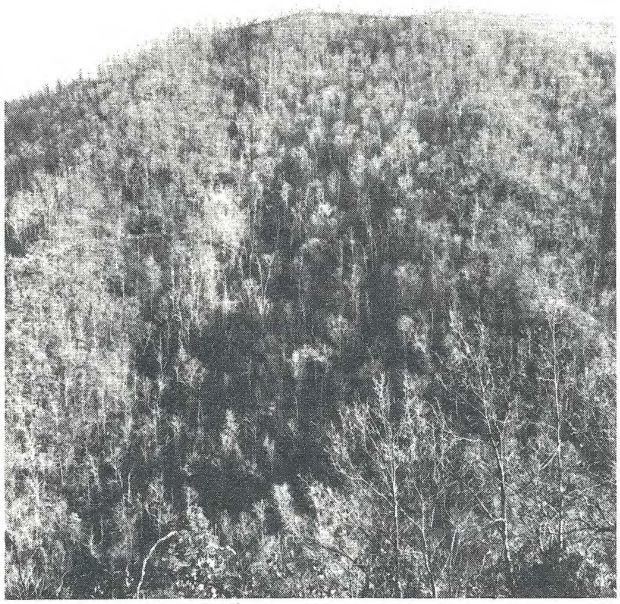
F-469692

The records in this storehouse are in continual use. They are the scientific data upon which the practical findings are based.

Each page of each book marks a sentence in a stream's life history, faithfully recorded by a weir. The studies to date give considerable practical information on the relationship of forests and water. They already tell a story of how man's treatment of forest watersheds can affect the flow and quality of the water in the streams, favorably or adversely.



F-469696

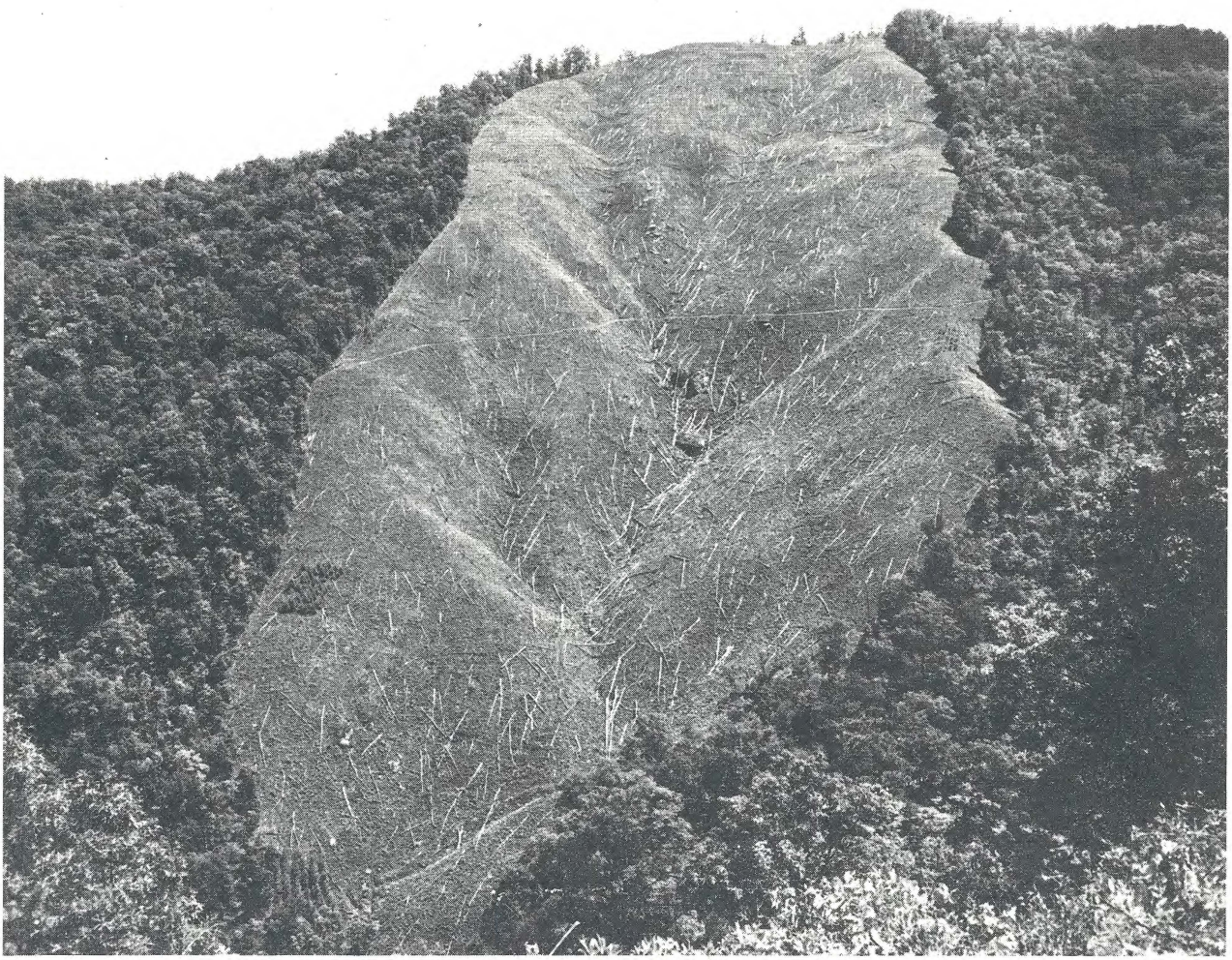


F-412416

FOREST-WATER RELATIONS

As part of every study, streamflow measurements are made for several years with the forest in its natural condition. During this "calibration period" the measurements give a picture of the streamflow that may normally be expected from the experimental area.

For 6 years the scientists measured the water flowing from this forest as nature made it. Then they clear-cut the drainage area, leaving every tree and bush where it fell, so as not to disturb the forest floor. It was in no sense a practical timber-cutting operation; the scientists only wanted to find out just how much water a forest drinks.



F-469765

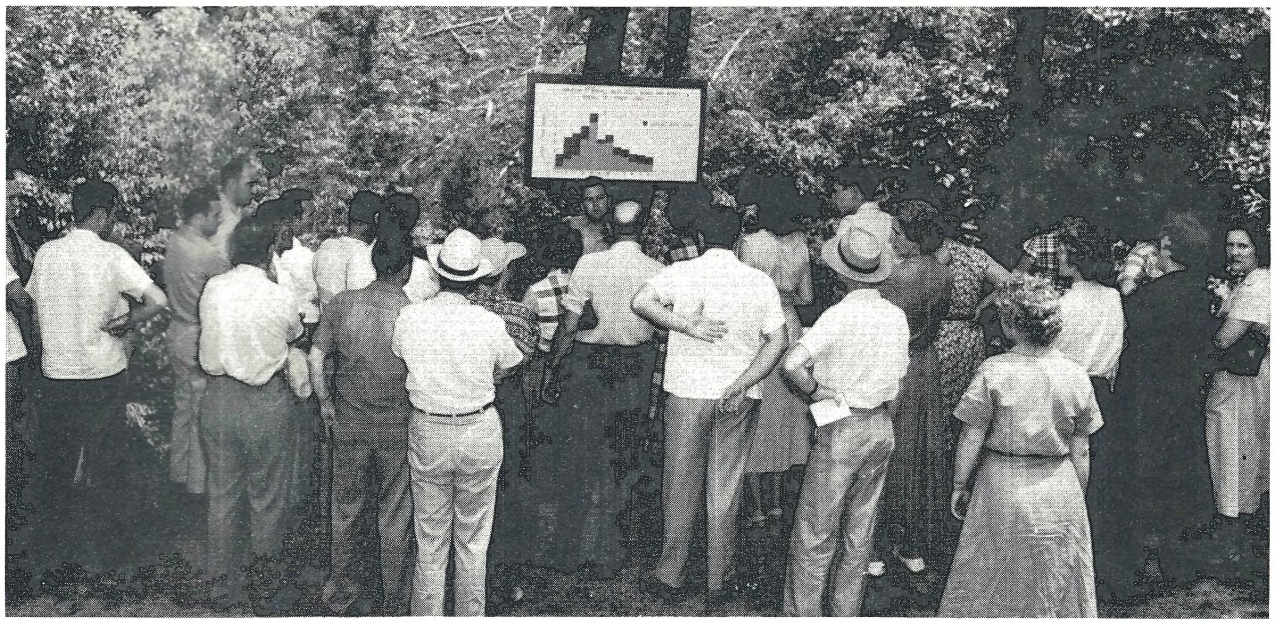
F-469759

Well, they found out that a forest drinks a lot of water. With all the vegetation cut down, though not removed, streamflow increased greatly with no loss of water quality.

F-469768

Every year a crew of men come on the area to cut down any new-grown sprouts. After 11 years there still had been no erosion, because the forest floor had not been disturbed.

The study is proving helpful to conservationists and teachers, and especially to scientists, engineers, and city water managers. They come to Coweeta to find out firsthand how forests may be managed to yield clean pure water in good supply—without damaging the land and its power to produce useful water. The answer lies somewhere between this exaggerated experiment and no timber cutting at all.



F-469798

F-412540

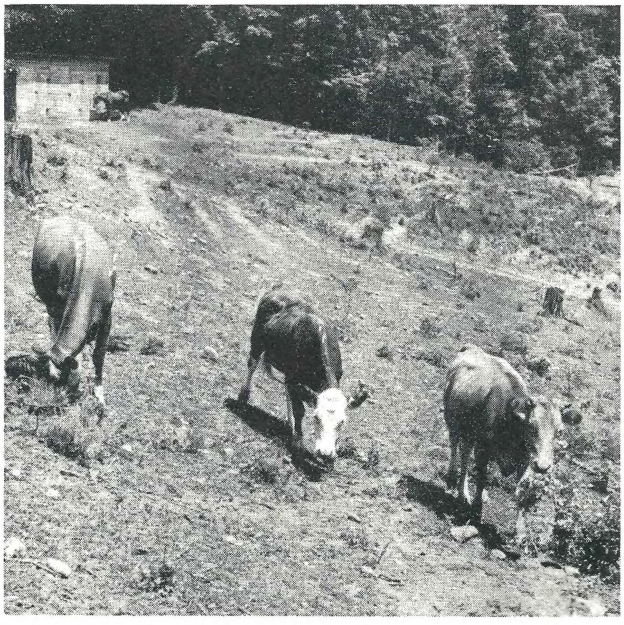
MOUNTAIN AGRICULTURE

This weir tells a story about mountain farming and the effect of steep-land agriculture on water and the soil. Here again, streamflow was recorded for several years under natural conditions. Then the area was cleared for agriculture, following as closely as possible the typical practices of many mountain people.

Part of the area was plowed and planted to corn. The crop gradually got poorer and poorer. After 5 years they didn't get even enough corn to pay for the seed.

F-469482

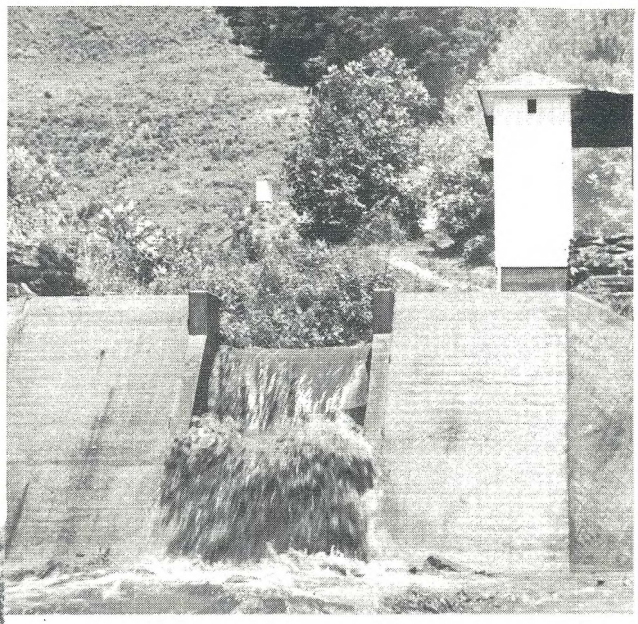
Part of the area was fenced—became a pasture for grazing. This didn't pay either. In a few years the cattle began having a hard time finding enough to eat.



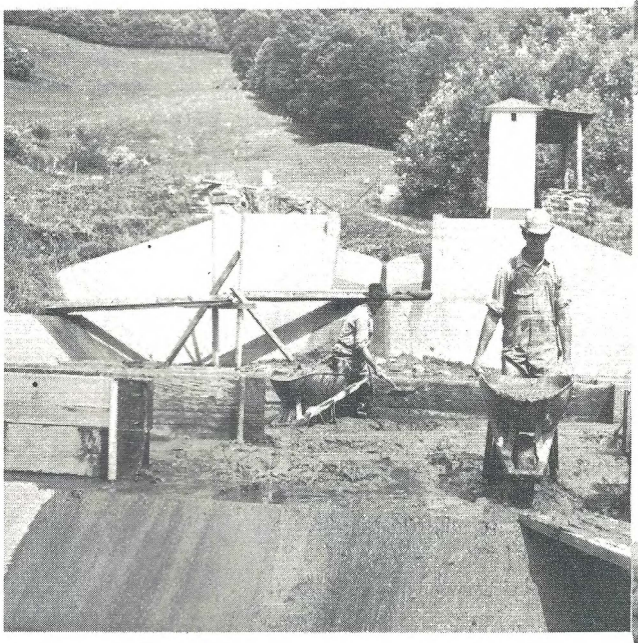
F-469702

Where once cool, clean water flowed steadily from the mountain area . . . now every rainstorm takes a toll of the soil, and the area has become a source of summer floods.

The soil on this mountainside just could not stand up under the strain of cultivation and pasturing. With every storm, tons of silt and debris now wash down the steep slope.



F-469708



F-469714

During one storm alone, 152,000 pounds of soil and rocks came off this 23-acre mountain farm area in 65 minutes of stormflow.

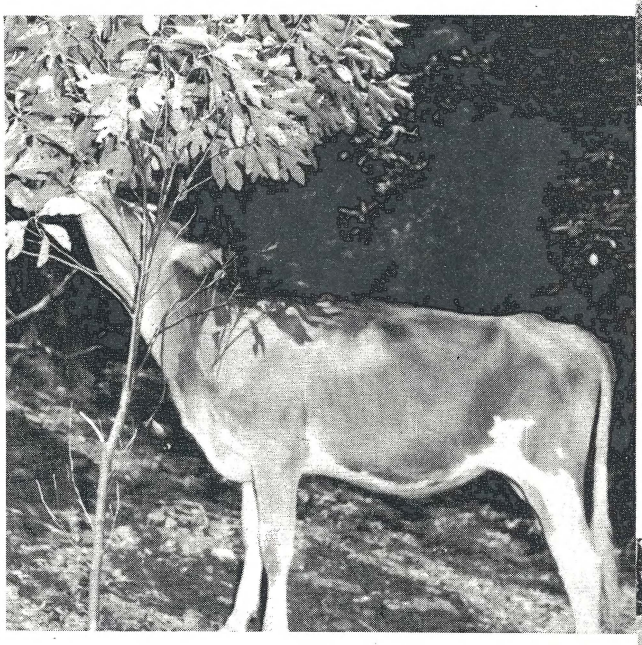
F-469713

Each spring the sediment that is removed from the catchment basins below the weir provides dramatic proof that frequent floods occur and valuable topsoil is lost when steep mountain slopes are used improperly.

WOODLAND GRAZING

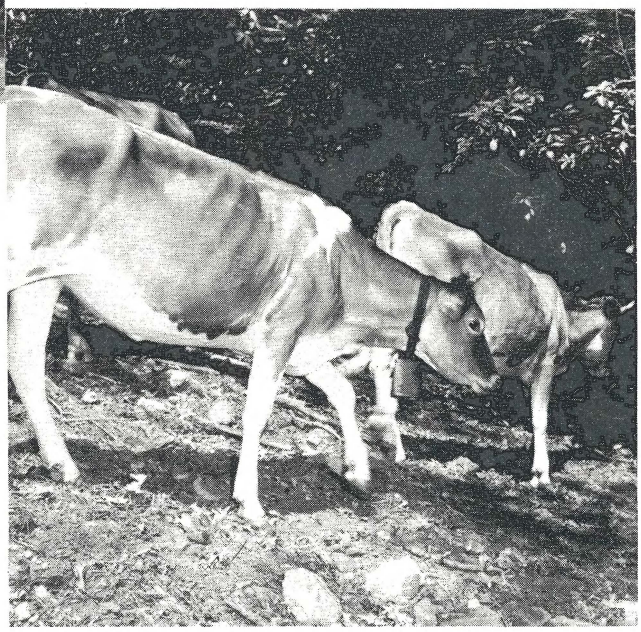
This is the story of improper grazing and its effect on land and water. For 7 years records were collected with the watershed in its natural condition. Then the area was fenced and cattle placed on it for grazing. The idea was to follow, as nearly as possible, the general practice on many farm woodlots throughout the mountain country of the Southeast, especially as to the number of cattle and the season of grazing each year.

F-469715



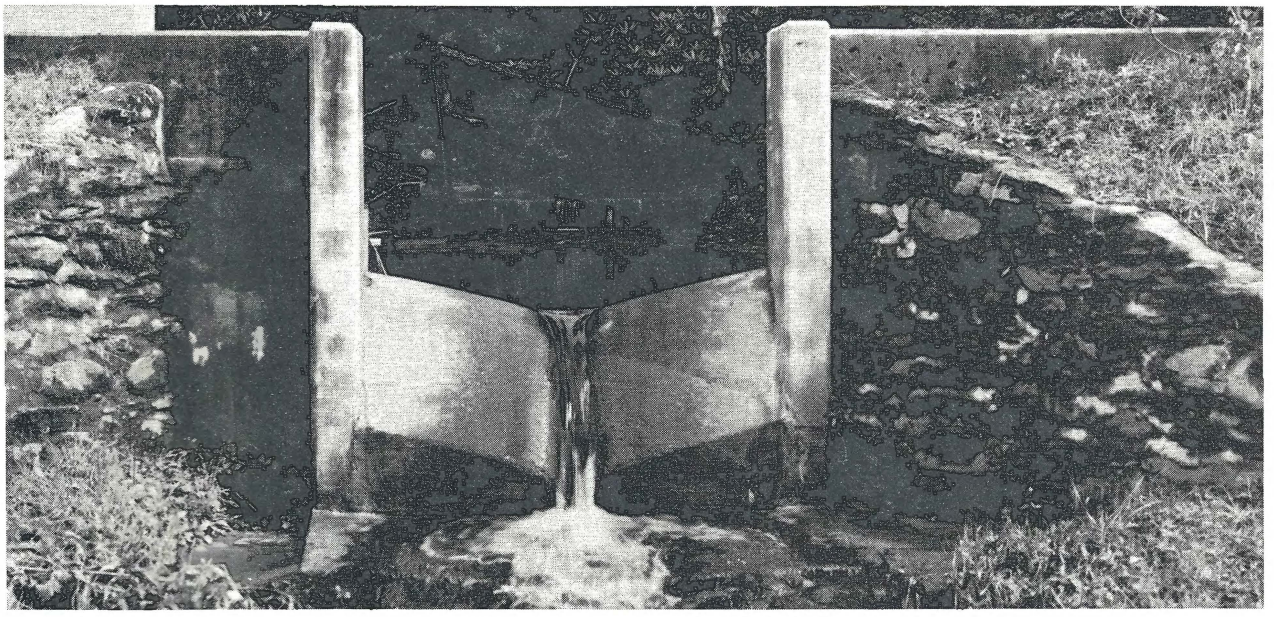
F-469719

In 6 years' time forage became scarce. The native legumes and grasses practically disappeared. Most of the young trees were heavily browsed, damaged beyond recovery.



F-469718

The ground became compacted from the trampling of cattle's hoofs. The upper 6 inches of soil, where most of the feeding roots of trees are located, lost most of its power to absorb the life-giving water . . . so even the larger trees suffered, because their growth too was retarded.



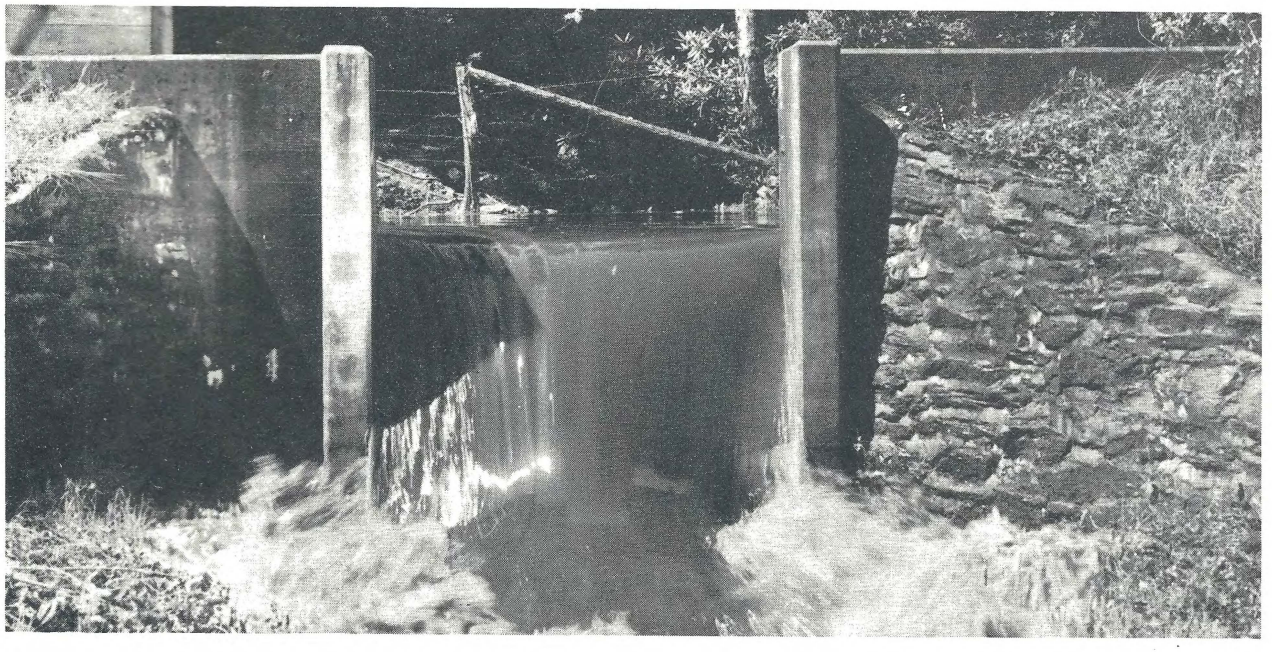
F-469722

Before grazing—

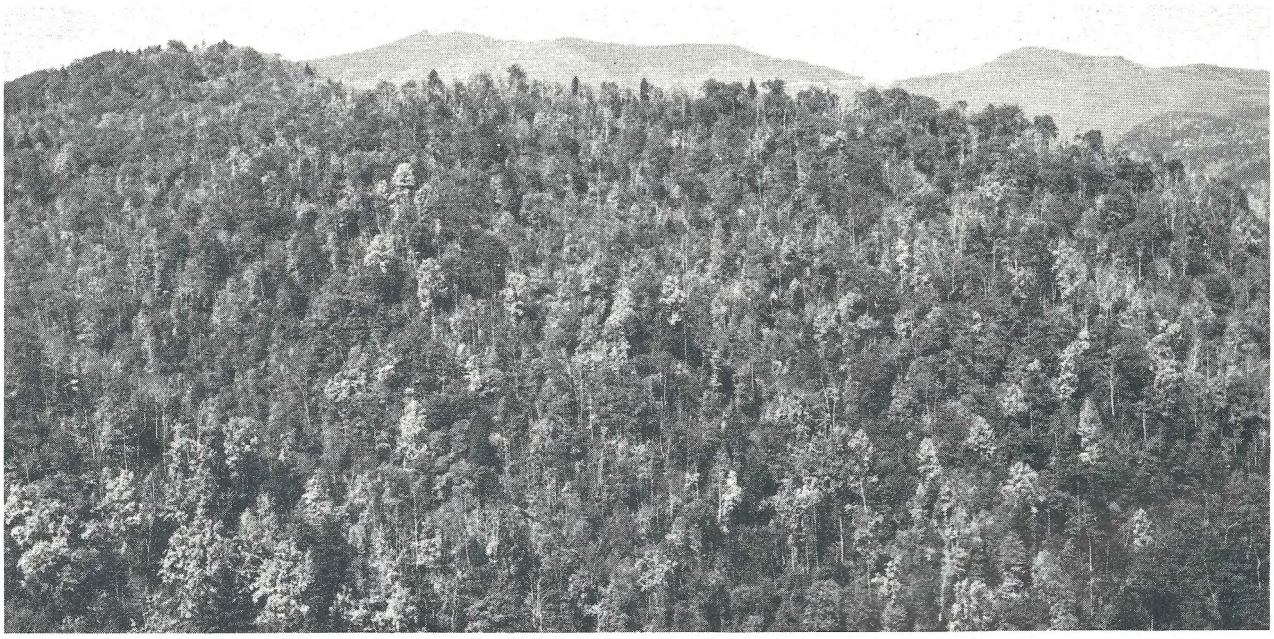
. . . all the rain that fell upon the mountain quickly went into the ground—flowing out as clear, pure water.

After grazing—

. . . the soil was less able to take in water during storms. Result: A watershed out of control with loss of important values—timber, soil, and water.



F-469723



F-447720

MOUNTAIN LOGGING

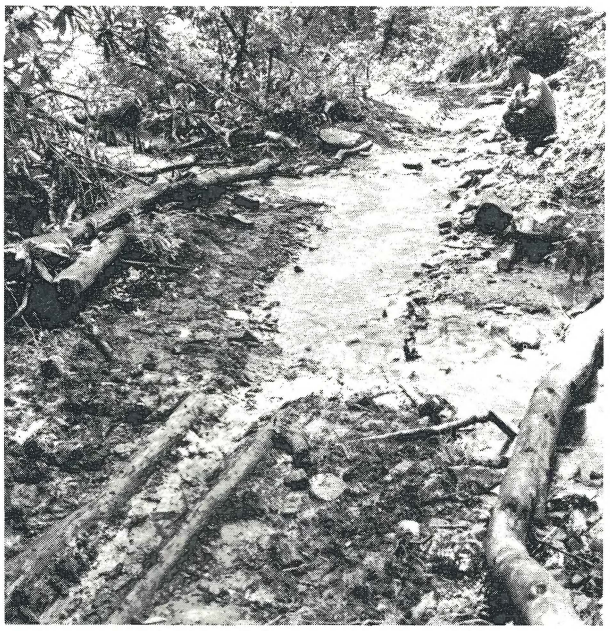
A 212-acre watershed was selected for this practical experiment. It was a fine oak and hickory area with a scattering of pine and blight-killed chestnut. Accurate tab was kept for 6 years of the clean, clear water flowing from this forest area. Then the merchantable timber was sold.

Roads and skid trails were "punched" into the area without proper regard to the lay of the land.

F-351474

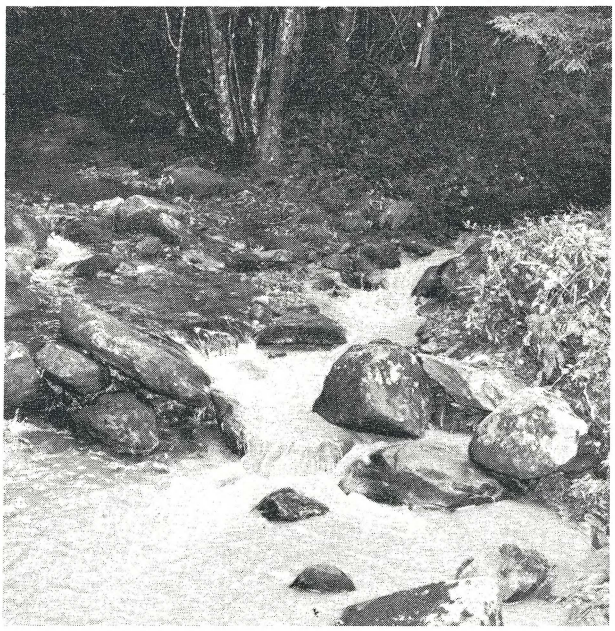
The purchaser was allowed to log as he wished without regard to good forest practice.

F-469739



F-441262

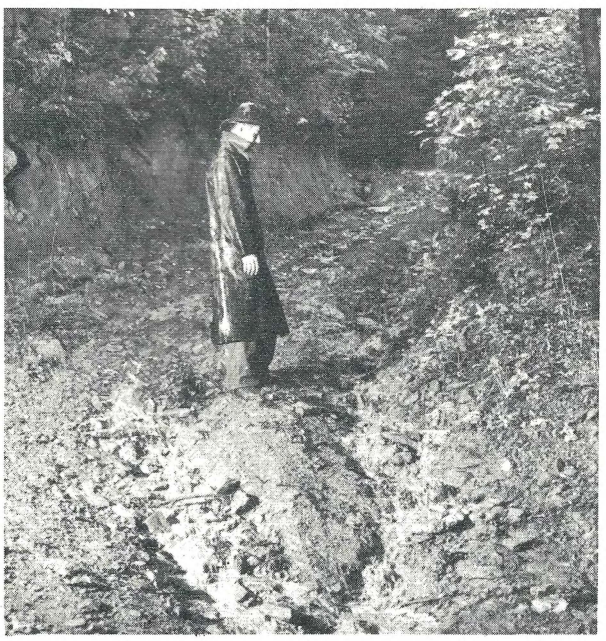
The effects were not long in showing up. Heavy runoff of water during storms—erosion. Silt and sediment filled the stream.



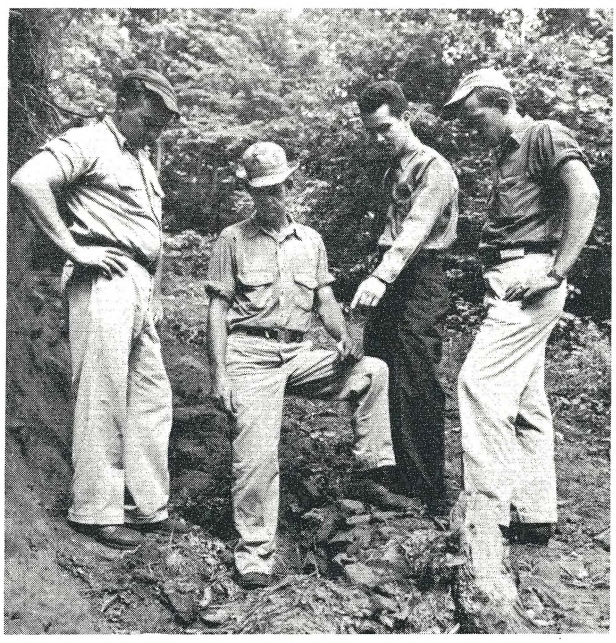
F-469747

As the muddy stream from the area joined clear-flowing ones, it fouled them too, and water quality was affected for miles downstream.

Hearing of these studies, many loggers come to Coweeta to find out how to improve their own road building and logging practices. They are beginning to realize that it's not only possible, but better economy, to cut the merchantable timber without ruining the land and its water and timber-producing values.



F-469745



F-469743

OTHER STUDIES

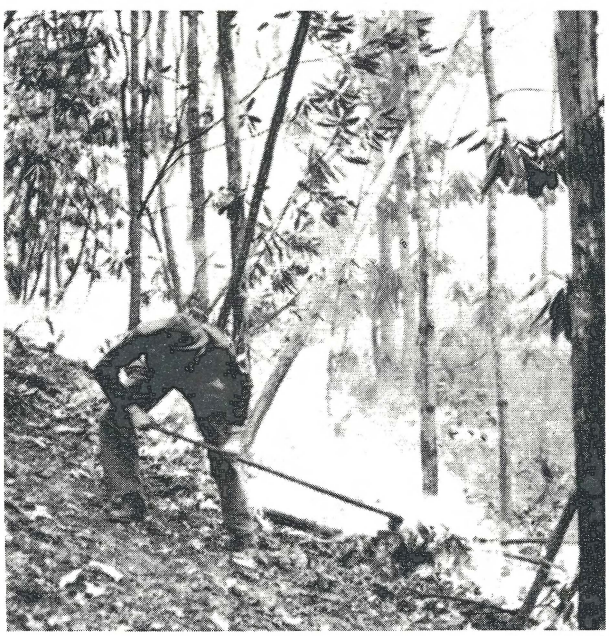
At this outdoor laboratory, other important studies are in progress or proposed. The records at Coweeta already cover 20 years of finding out just how the management of our forests—or their mismanagement—affects the flow of water in the streams. But there is still a great deal to be learned. For example:

F–469695

How would water yield be affected if you changed a hardwood forest to a pine forest?

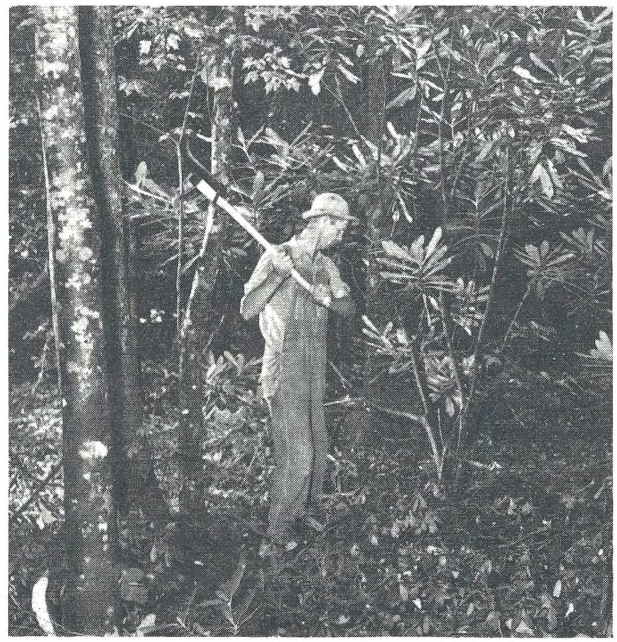
What effect does fire actually have on the land and its ability to store water?

F–352647



F–471187

F-469774

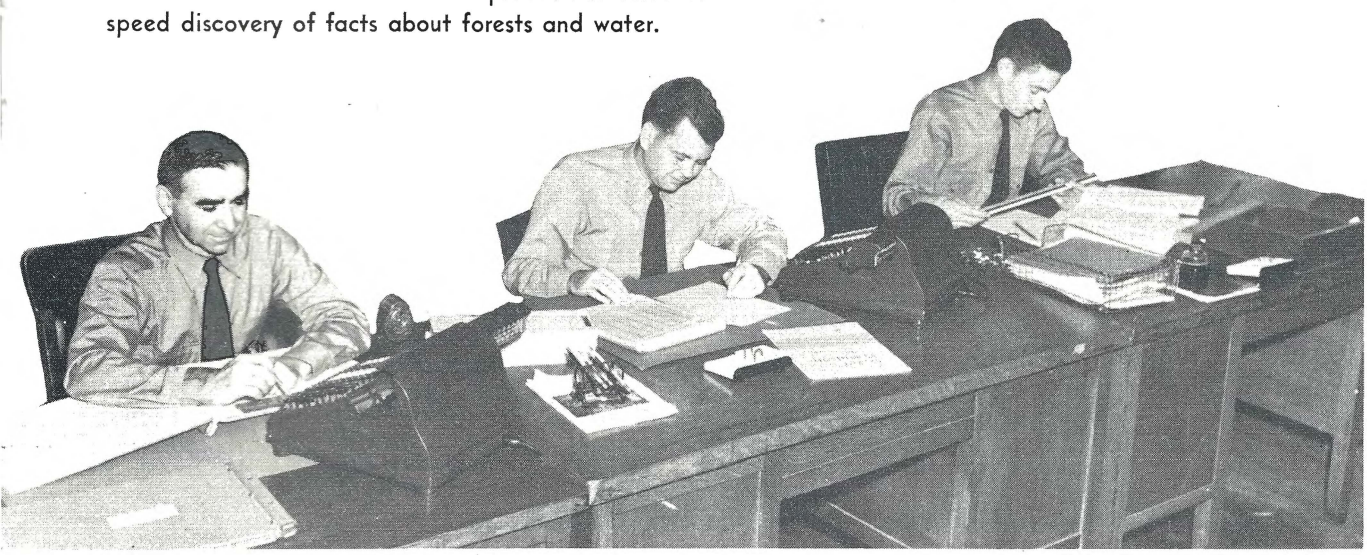


F-469757

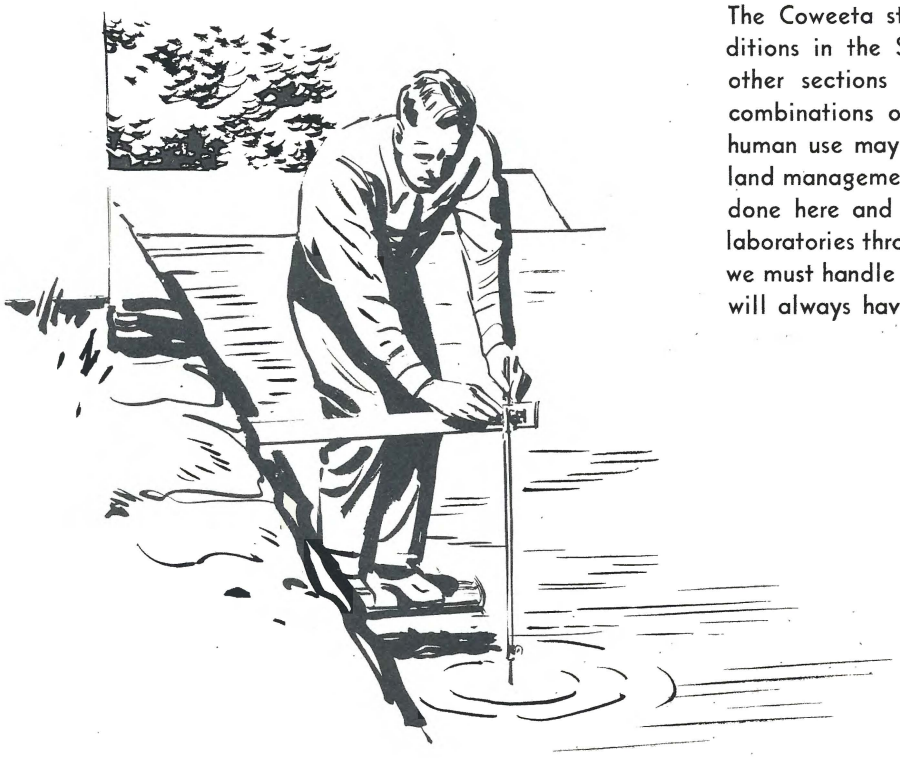
How are water temperature and quality affected by different forest treatments? Are the fish affected?

What is the effect on water yield of cutting the different kinds of vegetation on or away from the streams?

The men of Coweeta are steadily at work finding the answers. Research methods and procedures serve to speed discovery of facts about forests and water.

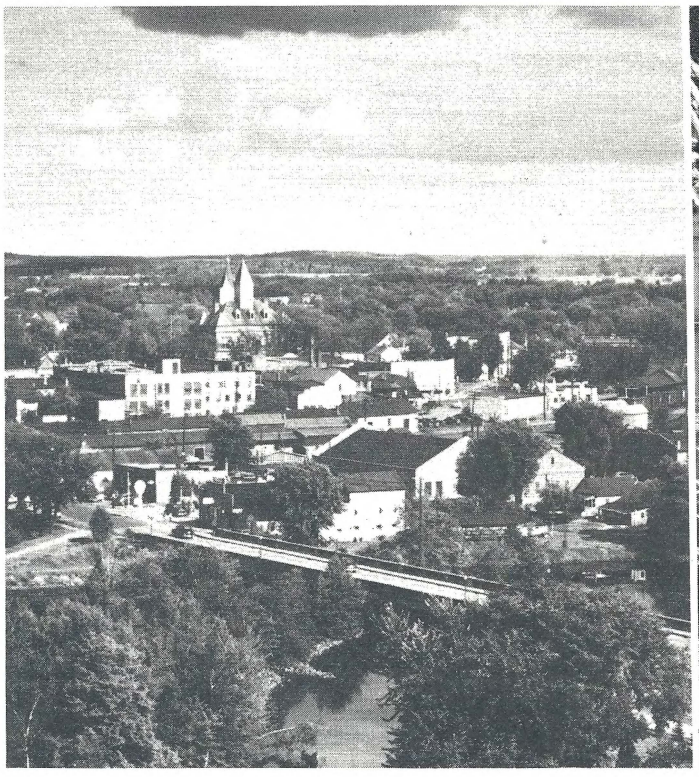


F-469697



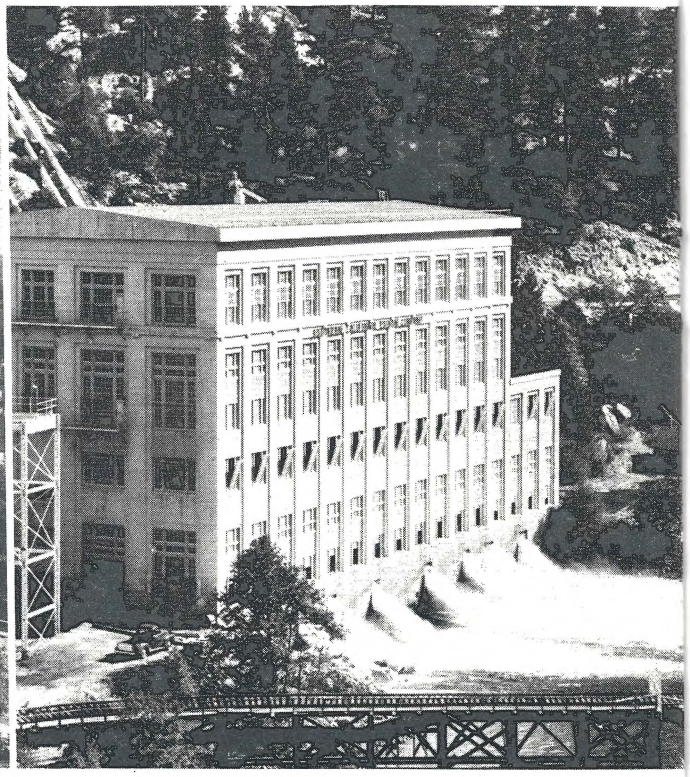
The Coweeta studies apply specifically to conditions in the Southeast but not necessarily to other sections of the country where differing combinations of climate, soil, vegetation, and human use may call for different approaches to land management. But because of what is being done here and at other Forest Service outdoor laboratories throughout the country, we know that we must handle our watersheds wisely, so that we will always have . . .

. . . WATER FOR CITIES



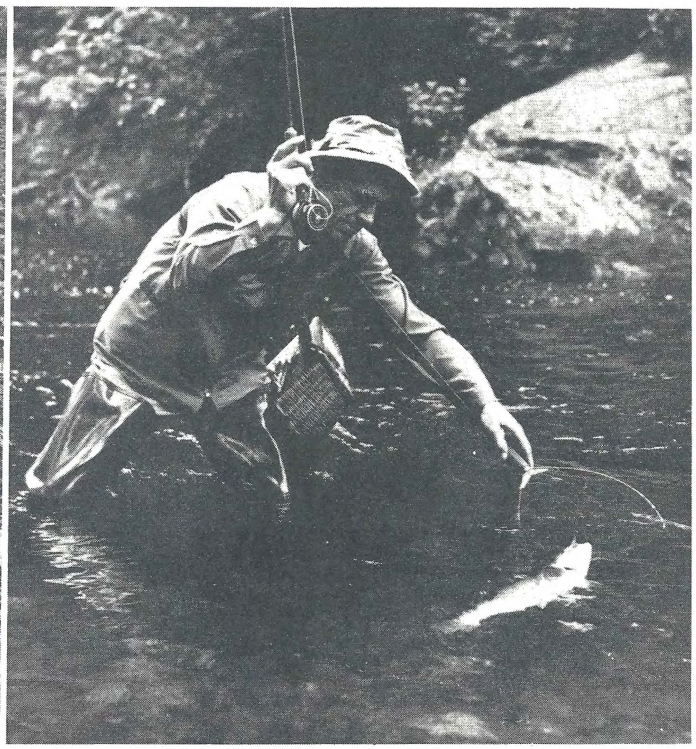
F-453894

. . . WATER FOR INDUSTRY



F-448004

F-440805



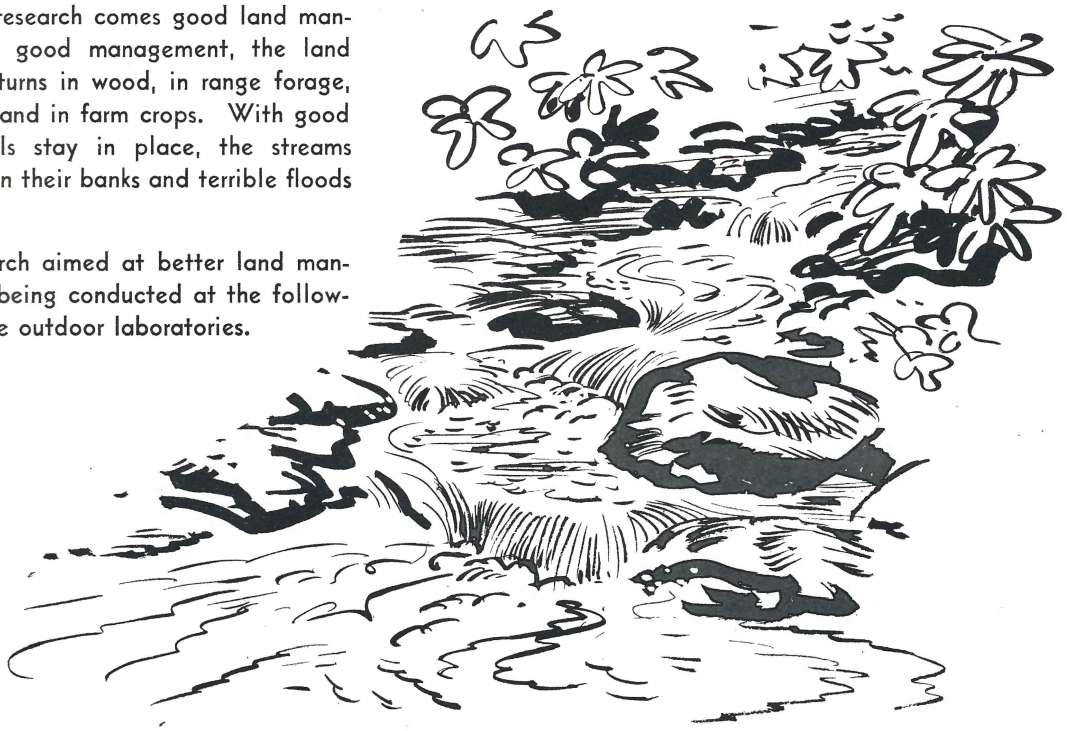
F-465156

. . . WATER FOR AGRICULTURE

From watershed research comes good land management. With good management, the land yields greater returns in wood, in range forage, in pasture grass, and in farm crops. With good management soils stay in place, the streams themselves stay in their banks and terrible floods are lessened.

Watershed research aimed at better land management is also being conducted at the following Forest Service outdoor laboratories.

. . . WATER FOR RECREATION

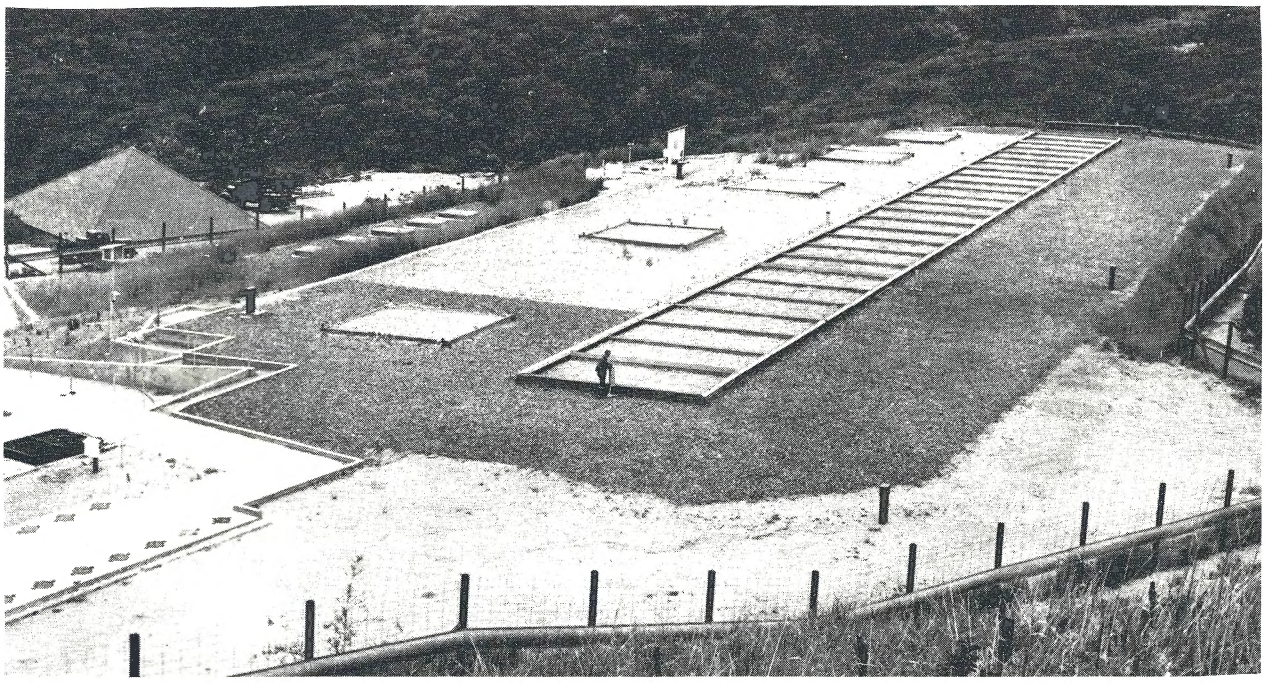


F-415746

At the Davis County Experimental Watershed (Farmington, Utah) where intense summer rains fall on the lower brush and grass-covered slopes, and heavy snows fall on the higher aspen forests, researchers are showing how to stop highly destructive mud-rock floods and increase late summer streamflow needed for irrigated crops.

At Fraser Experimental Forest (Fraser, Colo.), where much snow is caught on the crowns of dense, high-mountain spruce and pine stands and wasted by evaporation, scientists are testing small openings in the forest to store and slowly release through the soil more snow-water for thirsty cities and farms.

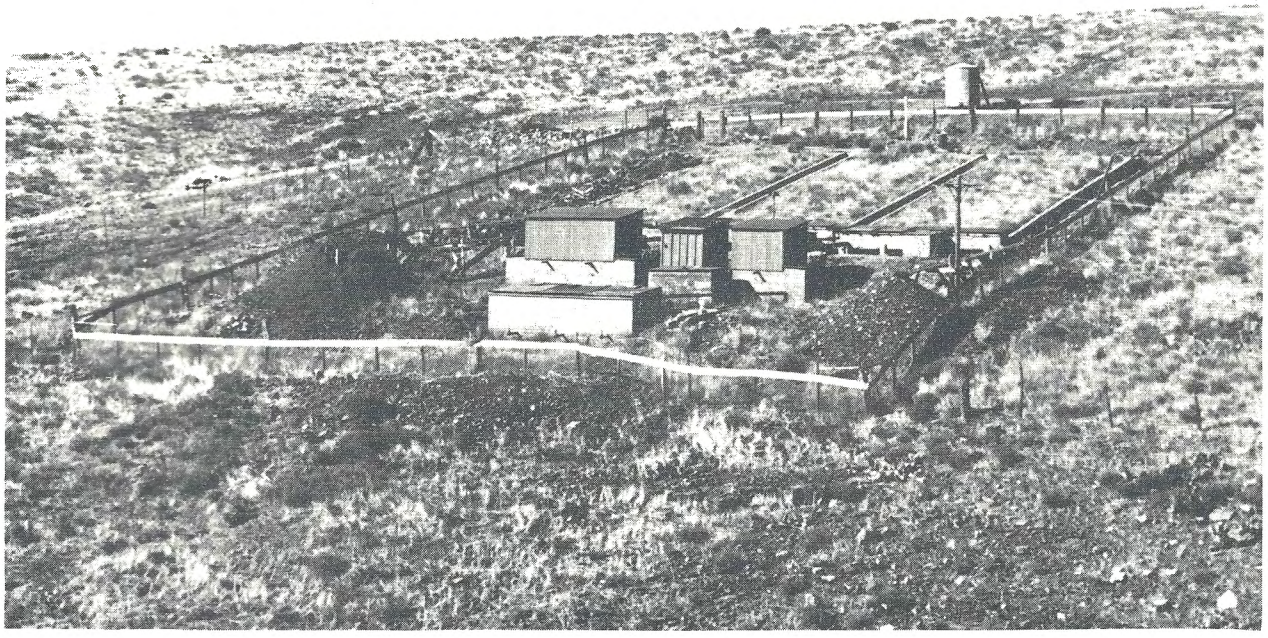
F-472297



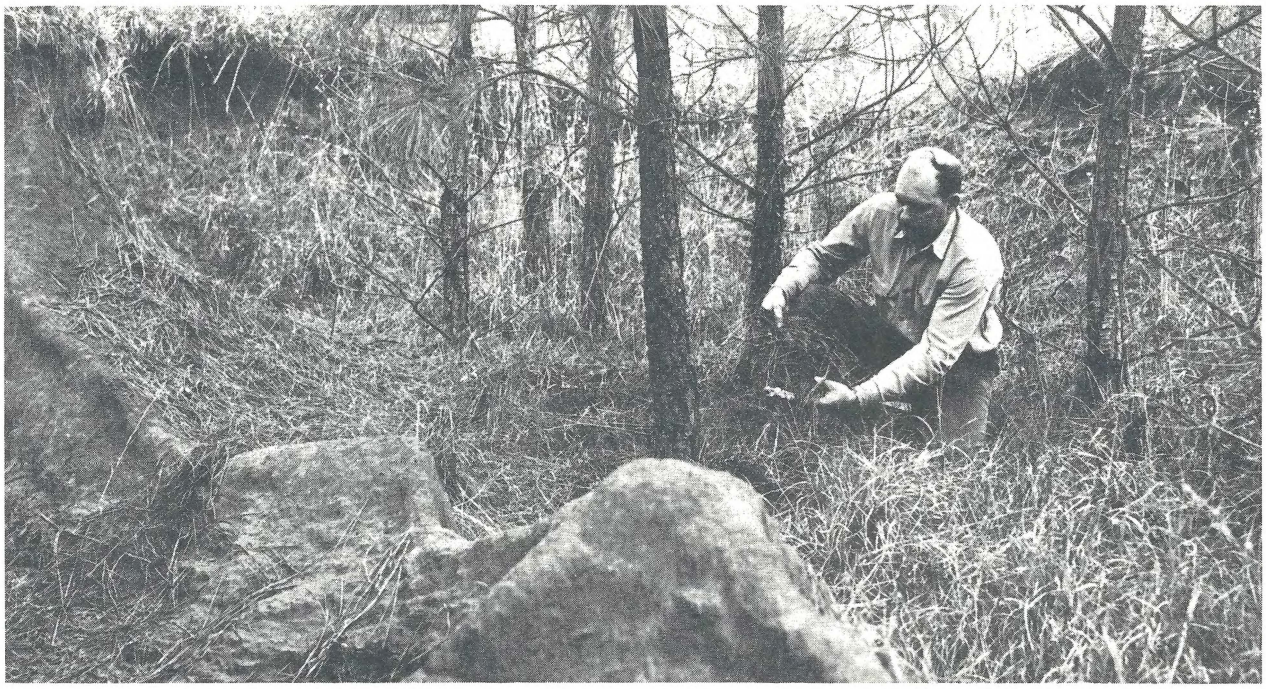
F-390465

At San Dimas Experimental Area (Glendora, Calif.) in the steep, rugged, brush-covered mountains near Los Angeles where summers are dry and hot, and winter brings snow and heavy rains, forest research specialists are developing methods to stabilize erodible slopes and channels and make more water available to rich agricultural valleys and populous communities below.

At Sierra Ancha (Globe, Ariz.) where semiarid grasslands and brush cover the lower elevations and humid evergreen forests occupy the higher slopes, a team of scientists is determining how best to manage range and forest lands to reduce excessive reservoir silting and conserve winter rains to help meet chronic water shortages.



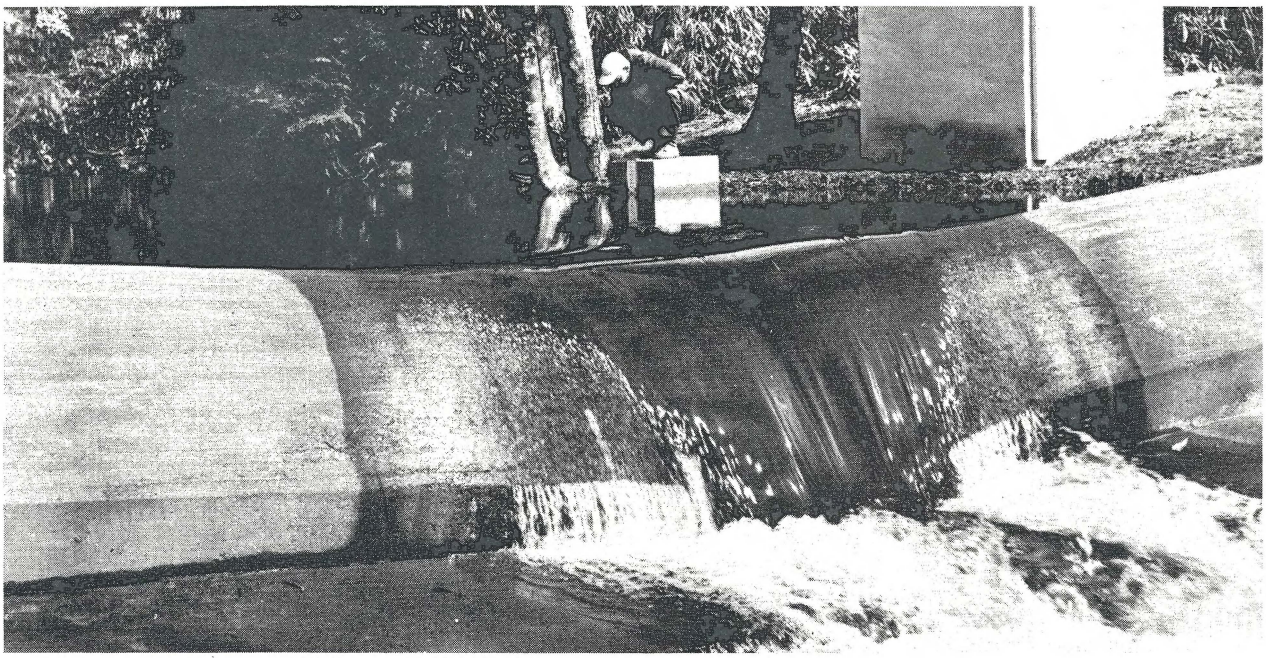
F-422754



F-458829

At the Tallahatchie Experimental Forest (Oxford, Miss.) where fires and unwise farm and forest practices have caused severe erosion, researchers are developing methods of restoring badly gullied land to usefulness so that it can again release clean, safe streamflow and serve man's urgent needs for abundant resources, security, and enjoyment.

At the Delaware-Lehigh Experimental Forest (Bethlehem, Pa.) the scientists are busily determining ways and means of restoring scrubby lands to productive forests, improving the soil cover to prevent damaging frost and rapid flood runoff, and providing clean, and more regular water supplies for the highly industrialized Delaware Basin.



F-472295

In addition to those illustrated in this booklet, there are other experimental forests and ranges in the Eastern and Western States where intensive watershed studies and tests are being carried on. Still other watershed studies are underway as a part of forest and range management research at many more Forest Service experimental areas.

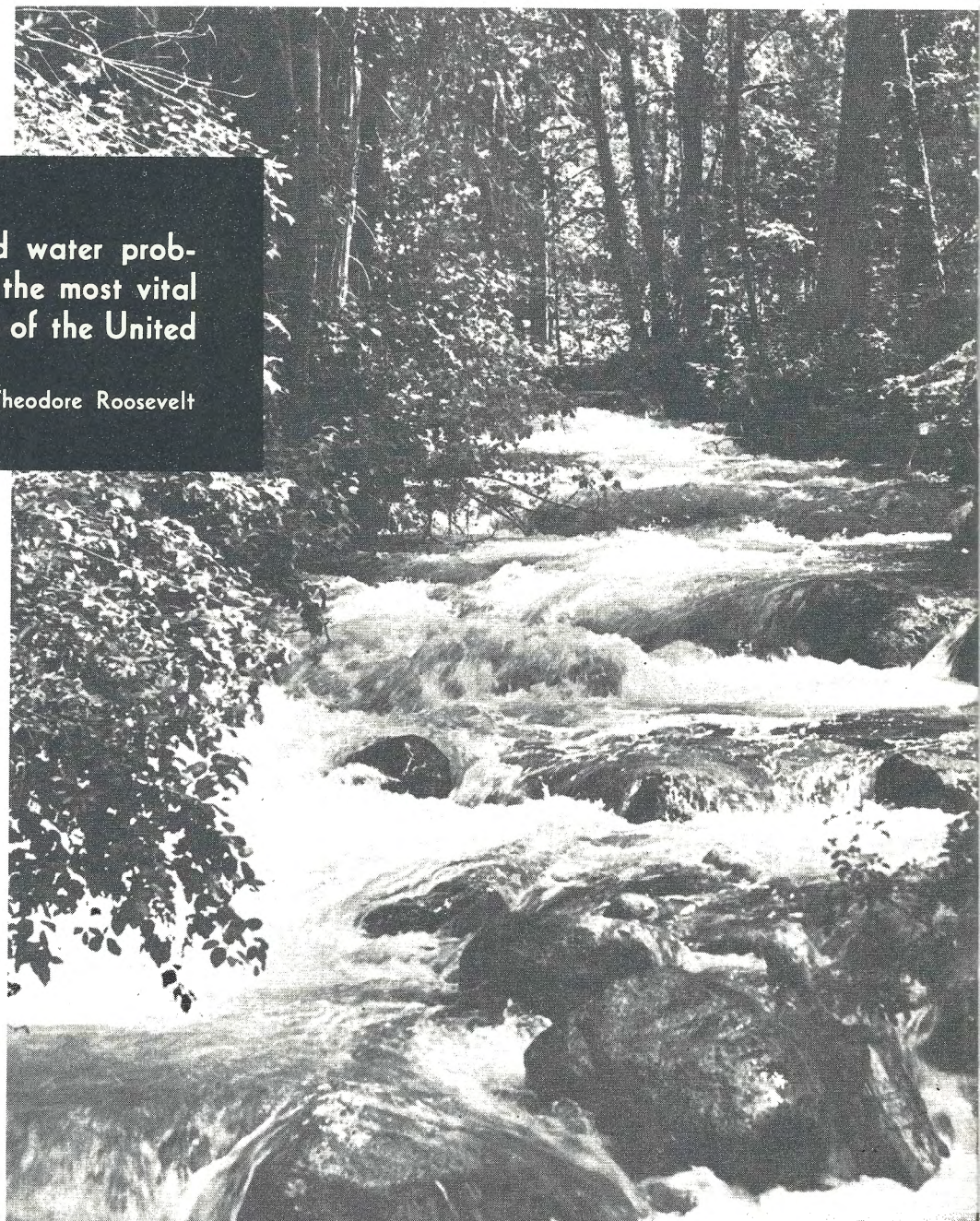
BACK COVER PHOTO—F-399256

For further information about research activities of the Forest Service, write to Chief, Forest Service, U. S. Department of Agriculture, Washington 25, D. C.

Issued December 1953

U. S. GOVERNMENT PRINTING OFFICE: O—1954

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. - Price 20 cents



"... forest and water problems are perhaps the most vital internal questions of the United States ..."

Theodore Roosevelt